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| **Environments** | **Investigation 5:** | **Brine Shrimp Hatching** |

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| **How this investigation fits within the Concept and Lesson Map:** |
| This investigation builds upon the idea that optimum conditions are within a range of tolerance. The concept of viability is also introduced. This investigation is the first to investigate populations, rather than individual plant’s response to environmental factors. Salinity is introduced as an aquatic environmental factor. The understanding of experimenting with just one variable is significantly important in this experiment. Student understanding and skills in designing a controlled investigation will continue to grow and differentiation should be given to those students ready for greater independence. |

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| **Overarching Question(s) for the Whole Investigation** |
| * How do populations respond to the environmental factors within the ecosystem? * How did the brine shrimp population respond to changes within the Mono Lake ecosystem? |

**How People Learn #1: Preconceptions**

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| **Eliciting Student Ideas:** |
| * Beginning of Investigation: What is an egg? How do birds hatch? |

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| **Common Student Preconceptions:** |
| * Students may think there is one ‘best’ salinity. However, a purpose of this investigation is to continue to build understanding of the idea of range of tolerance. * Students will think that Brine Shrimp that don’t hatch are dead. Usually, the case is that the eggs have not hatched because the optimum conditions for hatching have not been met. * Students may not know the definition of salinity. * Students may not understand that bodies of water other than oceans contain salt. |

**How People Learn #2: Facts/Concepts/Knowledge**

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| **WA State Content Standards “Science Domains” (EALR 4)** | |
| 4-5 LS2D | *Ecosystems* can change slowly or rapidly. Big changes over a short period of time can have a major impact on the *ecosystem* and the *populations* of plants and animals living there. |
| 4-5 LS2F | People affect *ecosystems* both positively and negatively. |
| 4-5 LS3A | In any *ecosystem*, some *populations* of *organisms* thrive and grow, some decline, and others do not survive at all. |
| **WA State Science Standards “Crosscutting Concepts and Abilities” (EALRs 1-3)** | |
| 4-5 SYSC | Systems have *inputs* and *outputs*. Changes in *inputs* may change the *outputs* of a *system*. |
| 4-5 INQC | An *experiment* involves a *comparison*. For an *experiment* to be valid and fair, all of the things that can possibly change the outcome of the *experiment* should be kept the same, if possible. |
| 4-5 APPD | Scientists and engineers often work in teams with other individuals to *generate* different *ideas* for solving a problem. |

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| **Key Understandings for the Teacher:** |
| * Brine Shrimp are not shrimp, they are crustaceans, “sea monkeys”. * Brine shrimp eggs have a narrow range of tolerance for salinity. * Mono Lake is used as the engaging scenario to support the focus question for the investigation. Google images and Google Earth are additional resources a teacher could use to visually show this ecosystem and location. |

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**How People Learn #3: Metacognition**

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| **Metacognition: How did my thinking change? What caused the change? How did I come to believe this?** |
| * At end of Student science notebook prompt for report to Dr. Bryan: How does the change in salinity of Mono Lake have an effect on brine shrimp hatching? What evidence do you have to support your claims? What suggestions do you have for those who manage the Mono Lake ecosystem? |

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| **Evidence of Student Understanding:** |
| * Student report to scientist Dr. Bryan at Mono Lake can be used as a formative assessment. Student claims and evidence from the controlled experiment should be generalized to the problem at Mono Lake. Students may describe their investigation set up and results. They may advise how the Mono Lake ecosystem should be managed in order to be within the Brine Shrimp’s range of tolerance. * Use the modified WA Edition: Assessment Environments response sheets and science notebook prompts. Response sheet for this investigation on pg. 18 of this assessment packet directly assesses the idea of viability. * Part 3: After Part 3 students should be given a chance to relate population ideas to individual organisms studied earlier. |

**Additional Information**

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| **Materials and Student Management** |
| * Overhead or document camera can be used to view the hatchings as a class. Initial hatchlings are very tiny and might be overlooked by students. As FOSS states, movement of containers and/or low light can impair observation. * You may want to use distilled water for this investigation if there are problems using tap water. Test ahead of time as FOSS suggests. * Be sure to not use iodinated salt. |

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| **Timing Considerations** |
| Timing is key for this investigation, as hatching may or may not occur between days 1-3. Students should be given time each day to observe for brine shrimp hatching. |

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| **Helpful Resources and Bibliography:** |
| * Washington Edition: Assessment Environments, Grade 5 Version (Updated formative assessment packet, 2006) * Atlas of Science Literacy, V2. (American Association for Advancement of Science, 2007) * Google images, Google Earth |